7047

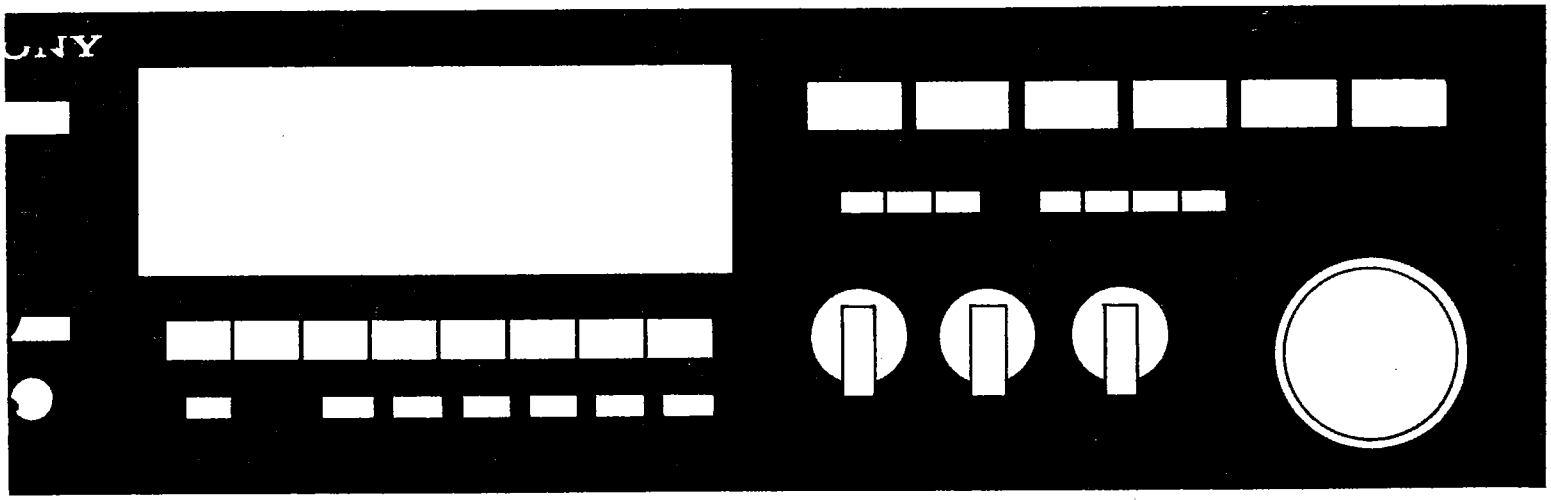
SONY®

Service Division

STEREO RECEIVERS

Models

STR-VX6, -VX5, -VX4, -VX3, -VX2, -VX1



circuit operation

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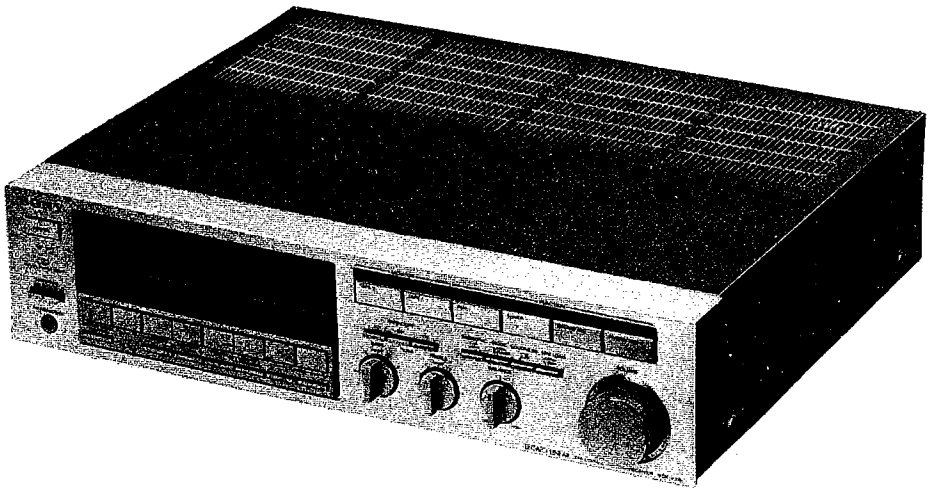
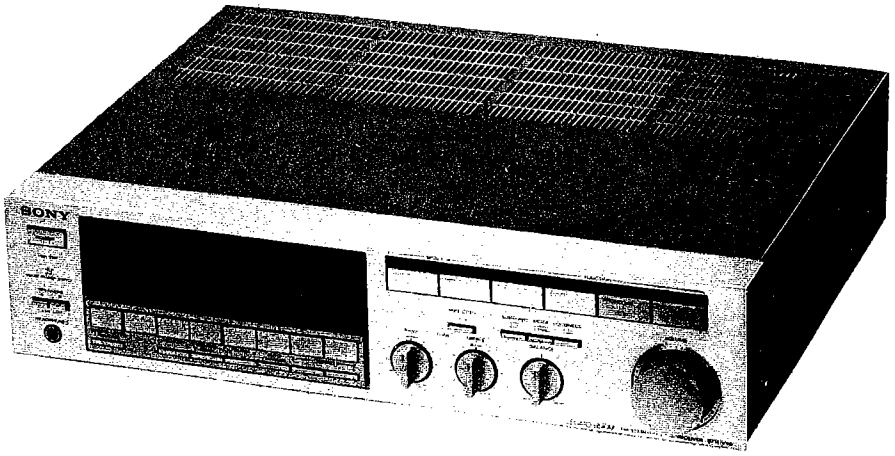
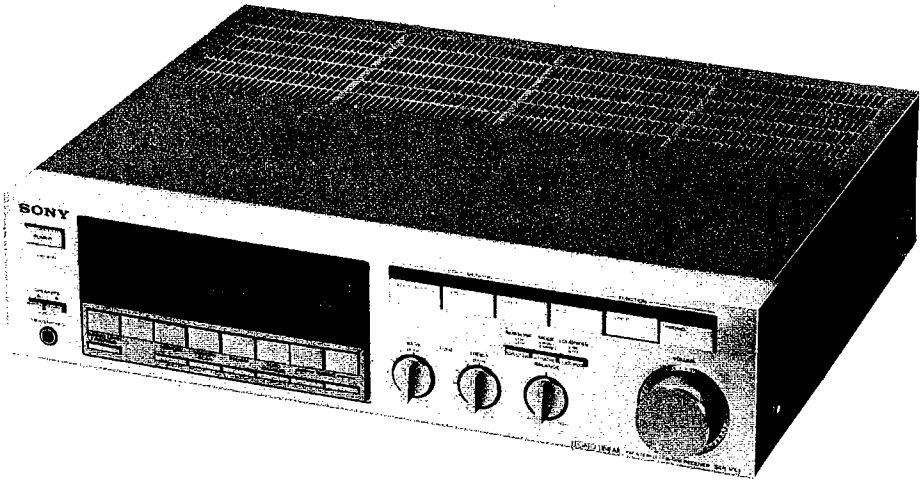


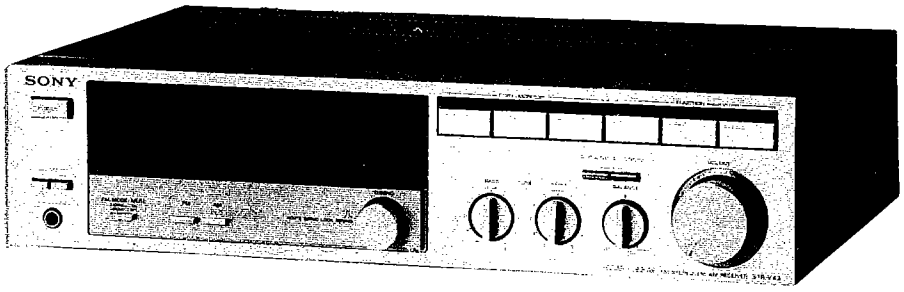
STR-VX6

STR-VX5



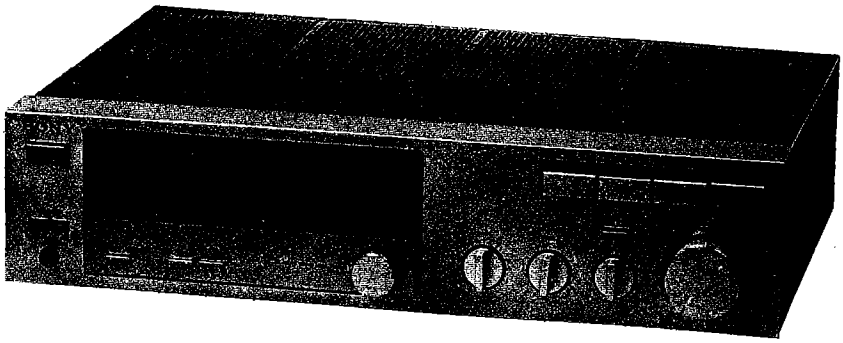


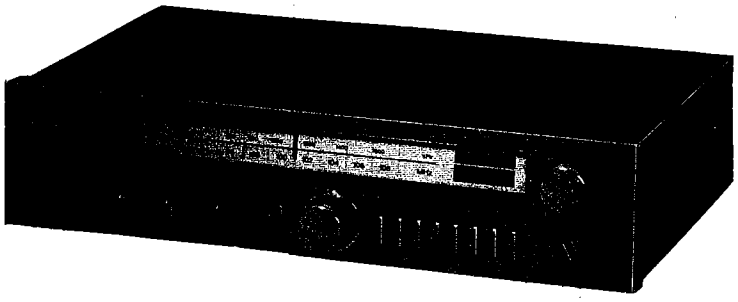
STR-VX4



STR-VX3

STR-VX2





STR-VX1

General Description

The STR-VX series is slightly different from the former STR-V stereo receiver series. The STR-VX series lineup is composed of six receivers from the STR-VX1 to the STR-VX6. The STR-VX6 is the top of the series, and employs a pulse power supply, Legato linear power amplifier, a 70-watt per channel amplifier, and a new PLL integrated circuit in the AM/FM tuner. Table 1 shows a comparison of the STR-VX series.

Table 1. STR-VX Series Comparison Chart

Feature	STR-VX6	STR-VX5	STR-VX4	STR-VX3	STR-VX2	STR-VX1
Output power per channel	70 W	55 W	40 W	35 W	28 W	22 W
DC amplifier & Legato Linear	yes	yes	yes	yes	---	---
Tuning system	PLL synthe-sizer	PLL synthe-sizer	PLL synthe-sizer	Acute Servo Lock	Acute Servo	Program Sensor
Auto tuning/memory scan	yes	yes	yes	---	---	---
Memory preset station	8(FM,AM)	8(FM,AM)	8(FM,AM)	---	---	5(FM)
Auto tuning level sensor	yes	yes	yes	---	---	---
Direct comparator	yes	yes	---	---	---	---
MC phono input	yes	yes	---	---	---	---
MM load selector	yes	---	---	---	---	---
Solid-state switch	yes	yes	---	---	---	---
Pulse power supply	yes	yes	---	---	---	---
Heat pipe	yes	---	---	---	---	---
Pre-out/main-in terminal	yes	---	---	---	---	---

Audio Section

STR-VX1, -VX2, -VX3, -VX4 Phono Equalizer

The entire phono equalizer section in the STR-VX1 and -VX2 is built around a high-performance integrated circuit. The STR-VX3 and -VX4 employ two transistors in a differential configuration before the integrated circuit to obtain a high signal-to-noise ratio (Figure 1).

STR-VX5, -VX6 Phono Equalizer

The basic circuitry in the STR-VX5 and -VX6 are identical to the STR-VX3 and -VX4. However, the STR-VX5 and -VX6 feature input capability for both moving-coil (MC) and moving-magnet type (MM) cartridges (Figure 2). The MC function is obtained by shorting R622 with the relay switch S602, and by reducing the input resistance to 100 ohms by S601. When the MC mode switch is depressed, DC voltage appears from the control circuit. This voltage is reduced by R821 and R824 and fed to the base of Q821 via R823. Then Q821 turns on to energize relay RY601 to close switches S601 and S602.

The STR-VX6 also features an input capacitance selector switch (180pF/330pF) for the MM cartridges by adding R649, C601 and S601-1.

STR-VX1, -VX2 Main Tone Amplifier

The STR-VX1 and -VX2 do not have separated tone and power amplifiers. The STR-VX1 and -VX2 employ a main amplifier with the tone control circuitry incorporated in the negative feedback loop. Because the power integrated circuits (STK-460 for the STR-VX1;

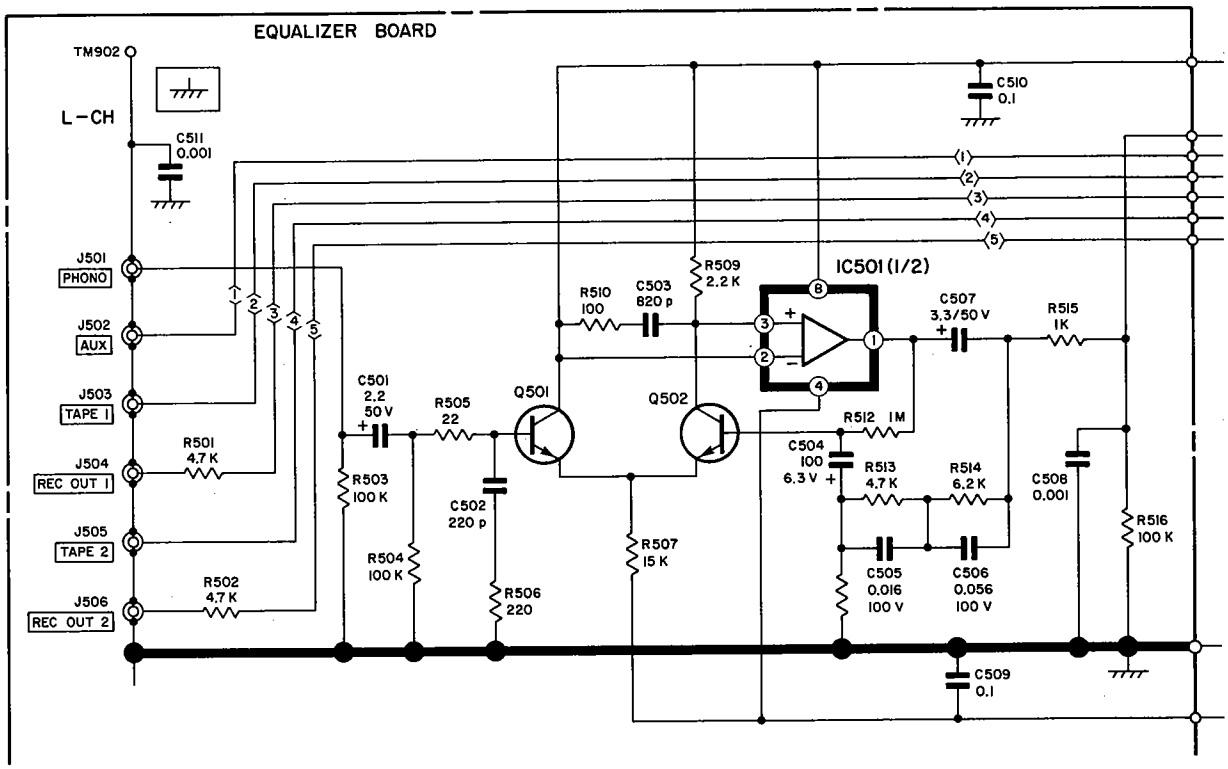


Fig. 1. STR-VX3 Phono Amplifier (Left Channel).

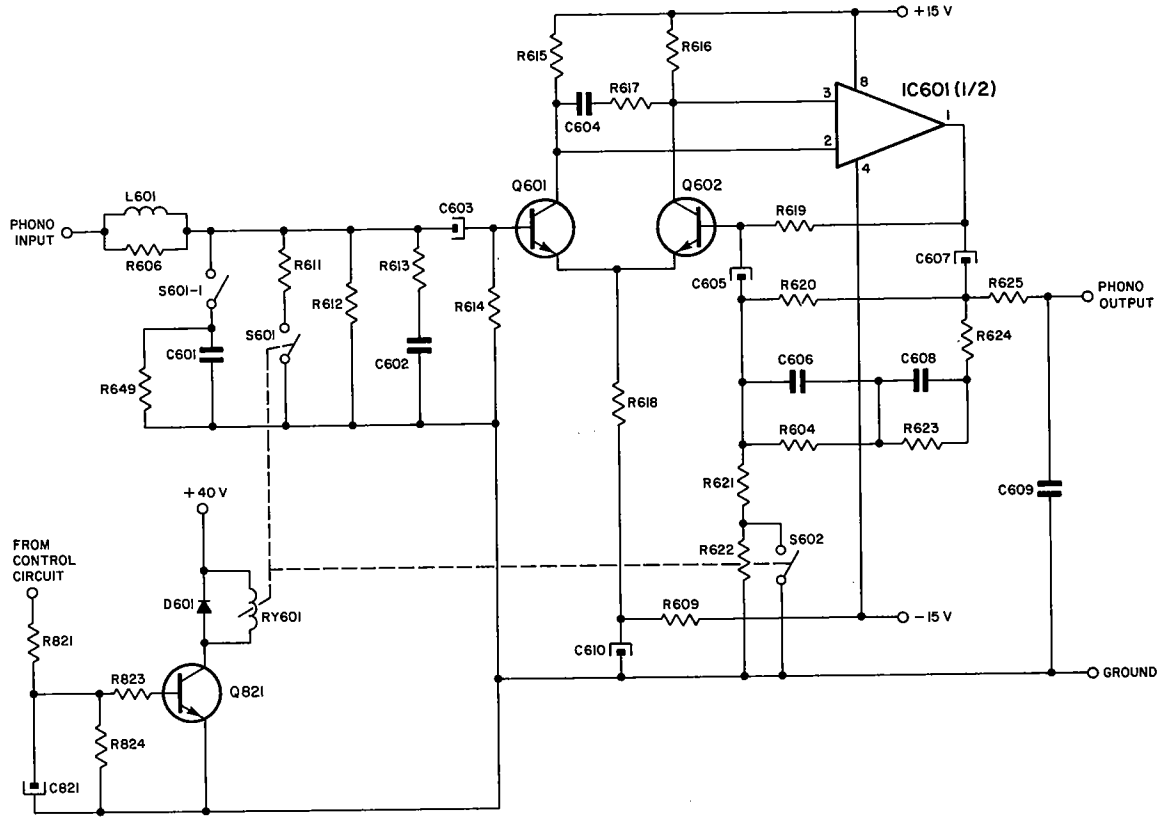


Fig. 2. STR-VX6 Phono Amplifier (Left Channel).

STK-463 for the STR-VX2) have high open-loop gain, when negative feedback is applied, noise and distortion will be reduced. Figure 3 shows the left channel main tone amplifier circuit of the STR-VX1. The simplified version of this circuit is shown in Figure 4. The negative feedback loop between pins 6, 7, and 2 is divided into two parts. The DC negative feedback is determined by R609, R608, and C605. AC negative feedback is determined by all peripheral components. By changing the amount of AC negative feedback with the variable resistors (RV604, RV605), we obtain the desired tone control response. C613 and R616 compensate for flatness at low frequencies. C606 is connected to prevent the tone control elements from affecting the DC negative feedback. C604, C609, R607, R613, C607, C608, R611 and R606 are the peripheral elements to make the circuit stable.

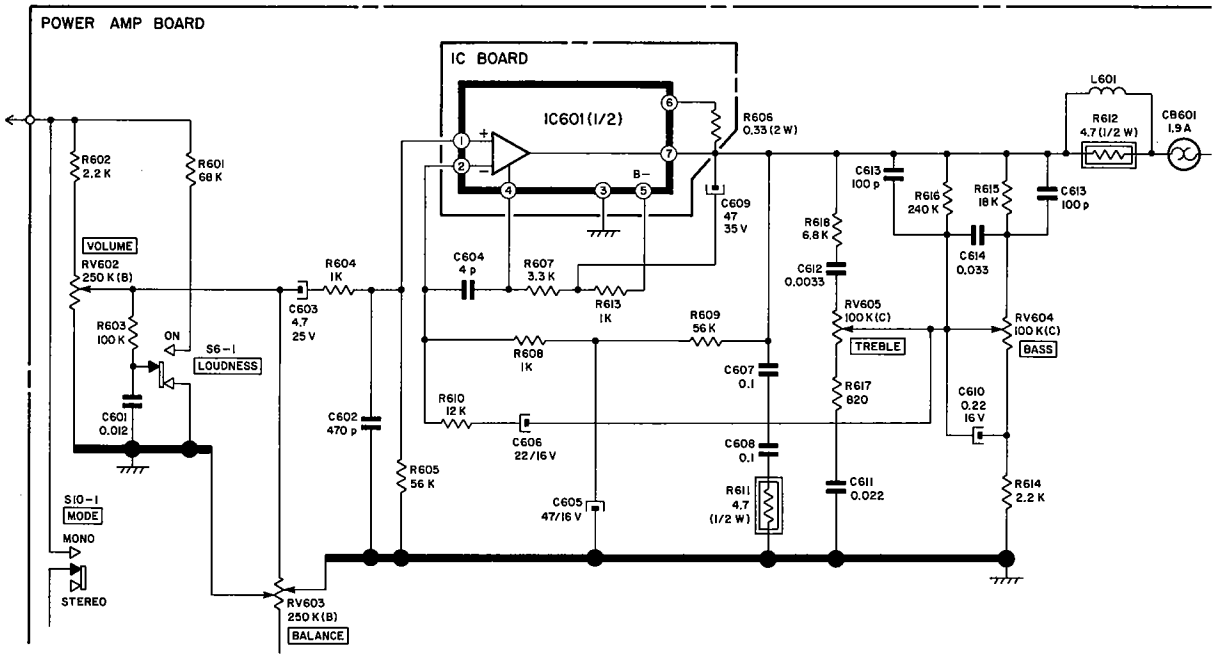


Fig. 3. STR-VX1 Main Tone Amplifier (Left Channel).

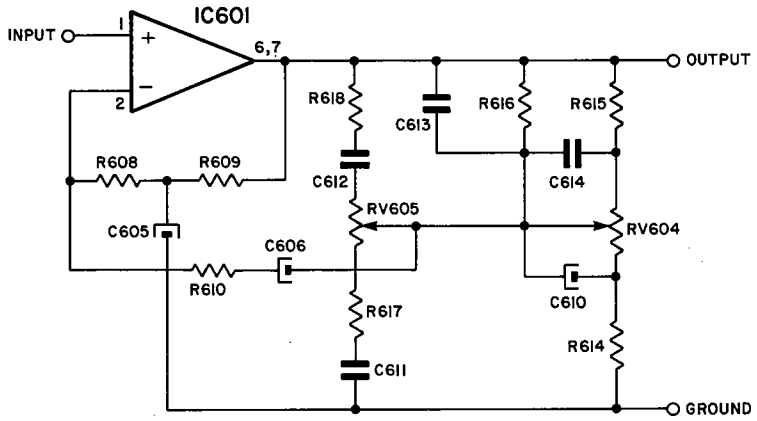


Fig. 4. Simplified Circuit of Fig. 3.

STR-VX3 Tone Amplifier

Like the STR-VX1 and -VX2, the whole control circuitry is built around the operational amplifier NJM4560D (IC601, Figure 5), which is connected in a non-inverting configuration with bass and treble controls incorporated in the negative feedback loop. The STR-VX3 features a subsonic filter that cuts the noise by 12 dB per octave below 15 Hz. This is to eliminate such very low frequency noise as the rumble produced by phono records. Figure 6 shows the simplified subsonic filter circuit of the STR-VX3. When the subsonic filter switch (S6-1) is depressed, the circuit operates as a two-stage high-pass filter (Figure 6b).

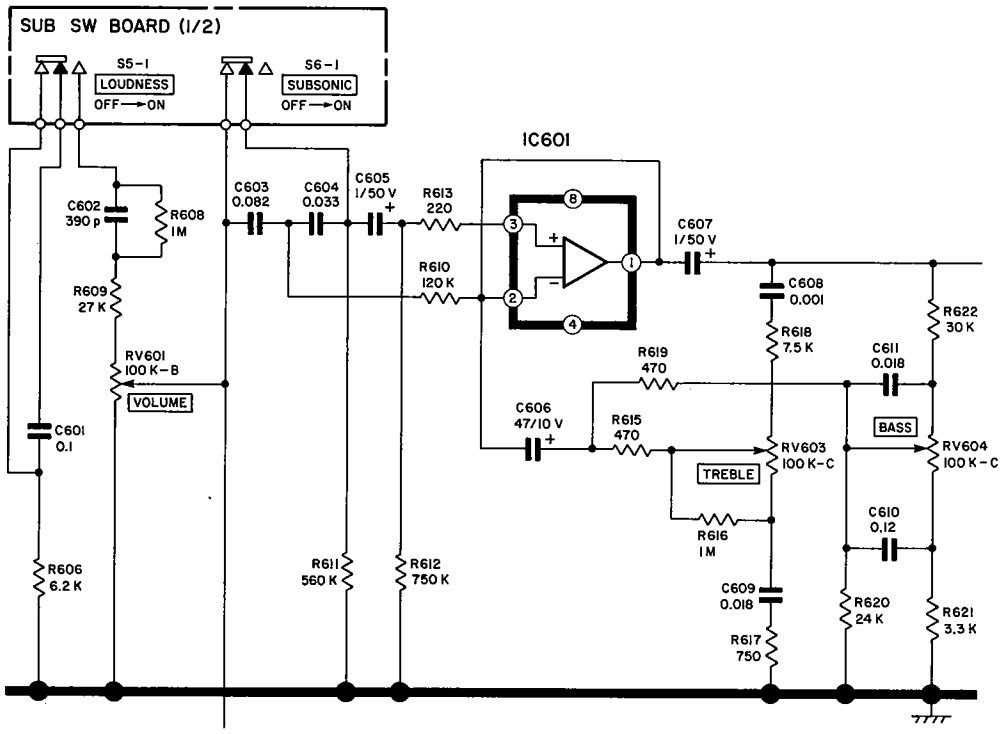


Fig. 5. STR-VX3 Tone Amplifier (Left Channel).

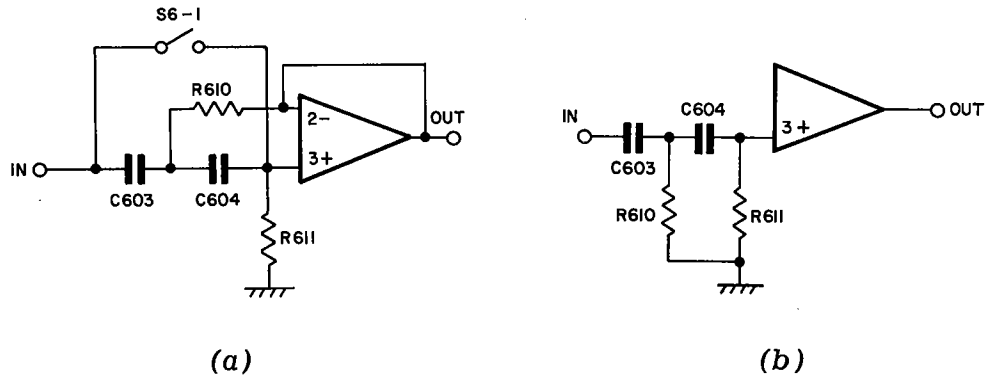


Fig. 6. STR-VX3 Simplified Subsonic Filter Circuit.

STR-VX4, -VX5, -VX6 Tone Amplifier

Four discrete transistors are employed in the tone amplifier (Figure 7). Q603 and Q604 are connected in a differential configuration to eliminate the common-mode noise coming from B+/B- line. Q605 further amplifies the voltage signal coming from Q603. Q606 acts as a constant-current load for Q605. The bass and the treble controls are connected in the negative feedback loop. The STR-VX4, -VX5 and -VX6 also have subsonic filter circuitry. The operation of the circuit is identical to that of the STR-VX3. The STR-VX6, which is the top model of the STR-VX series, features pre-out/main-in terminals for expanded utility.

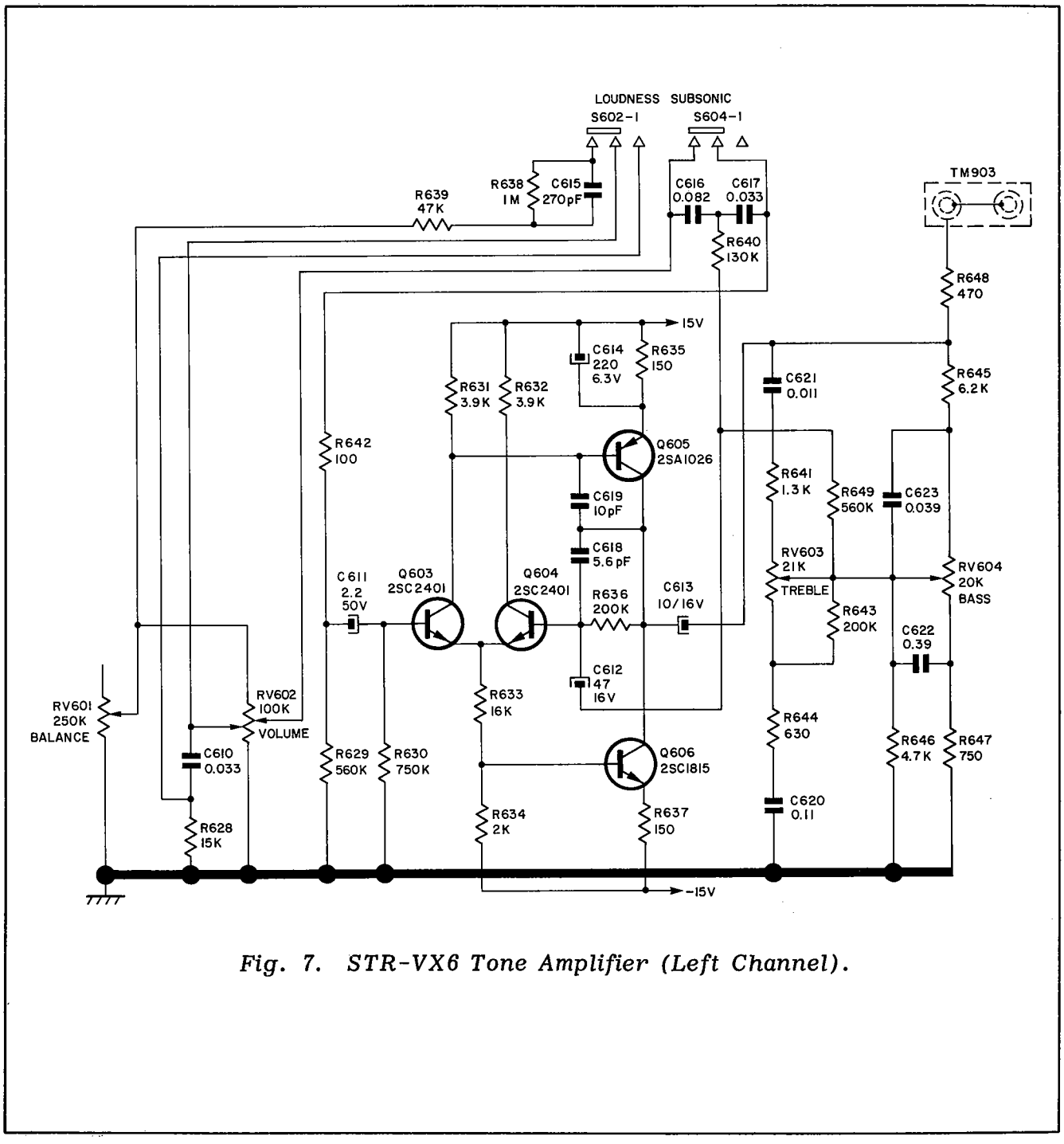


Fig. 7. STR-VX6 Tone Amplifier (Left Channel).

STR-VX3, -VX4 Power Amplifier

These two models employ two kinds of integrated circuits. The STK-3042II is a voltage amplifier, and the STK-2230 is a current amplifier (Figure 8). Both integrated circuits contain two channels. Unlike the power integrated circuit built on one chip, the voltage amplifiers and current amplifiers are separate. This isolates the magnetic flux and provides low noise and distortion. The DC offset voltage is adjustable with the semivariable resistors RT701 and RT751, but the idling current is fixed internally.

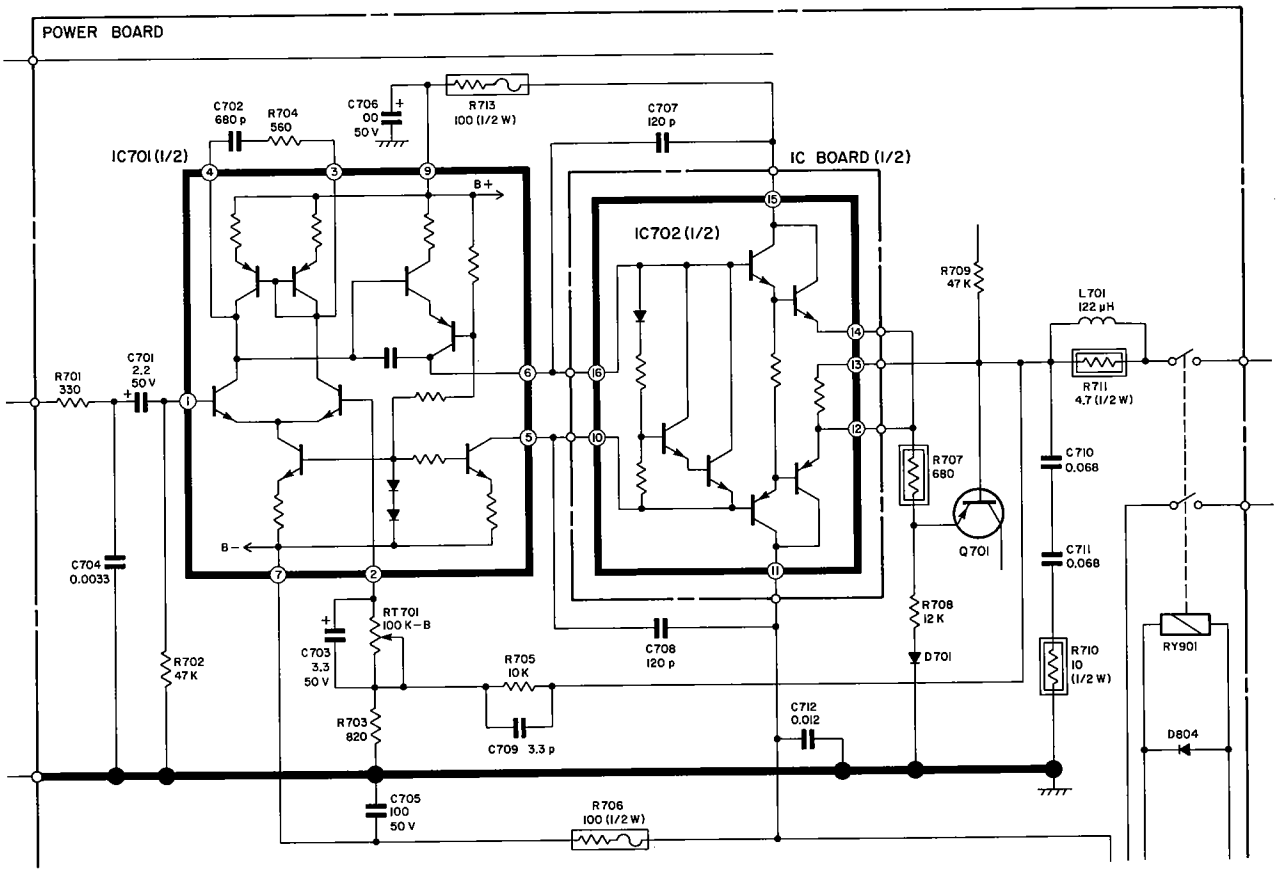


Fig. 8. STR-VX3 Power Amplifier (Left Channel).

STR-VX5, -VX6 Power Amplifier

The left-channel power amplifier circuit of the STR-VX5 is shown in Figure 9. In the first stage, a dual PNP transistor (Q702) is connected to a dual NPN transistor (Q701) as a current mirror for high voltage gain. The DC offset voltage can be zeroed by RV701 if slight DC imbalances occur. The second stage, which consists of Q703 and Q704, supplies more voltage gain. The base-emitter voltage of Q705 is regulated by D701, D704, and R717. Q705 acts as a regulated current source for Q703 and Q704. D702, which is a varistor consisting of four diodes connected in series, biases the output stage in class AB mode to reduce crossover distortion. The bias current is adjustable by RV702. The complementary output stage consists of Q706, Q707, Q708 and Q709.

The power amplifier of the STR-VX6 is nearly identical to that of the STR-VX5, except for the absence of an input capacitor, and a dual FET (Q701), which configures a DC amplifier. Q703 and Q704 are connected between Q701 and the current mirror Q702 to reduce high-frequency distortion caused by the gate-drain capacitance of Q701. Q705, D701, D702 and R710 are a regulated current source for Q701, and the DC offset voltage is adjustable by RV701. Current gain is supplied by Q710, Q711, Q712, Q713, Q714, and Q715, which are connected in a three-stage Darlington arrangement.

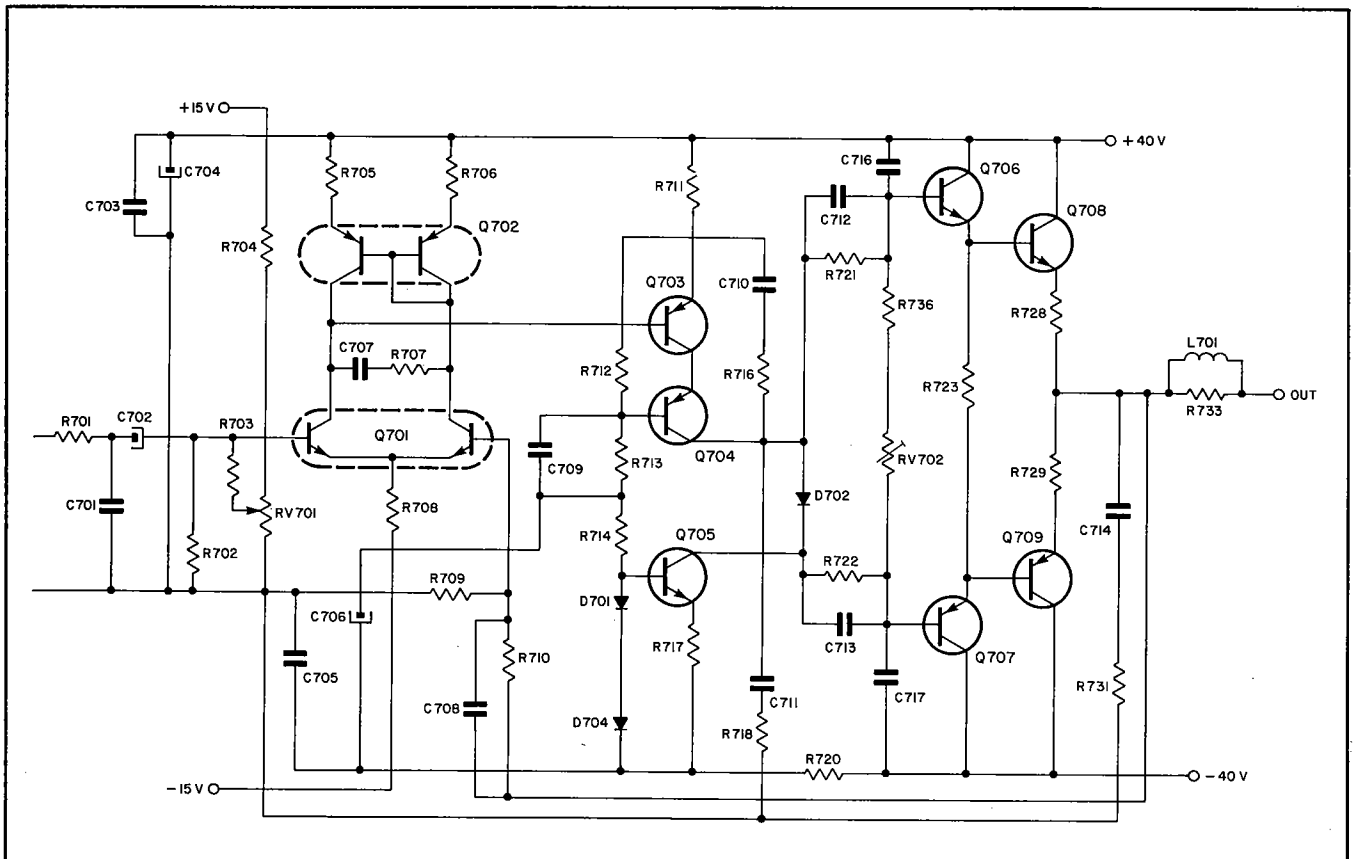


Fig. 9. STR-VX5 Power Amplifier (Left Channel).

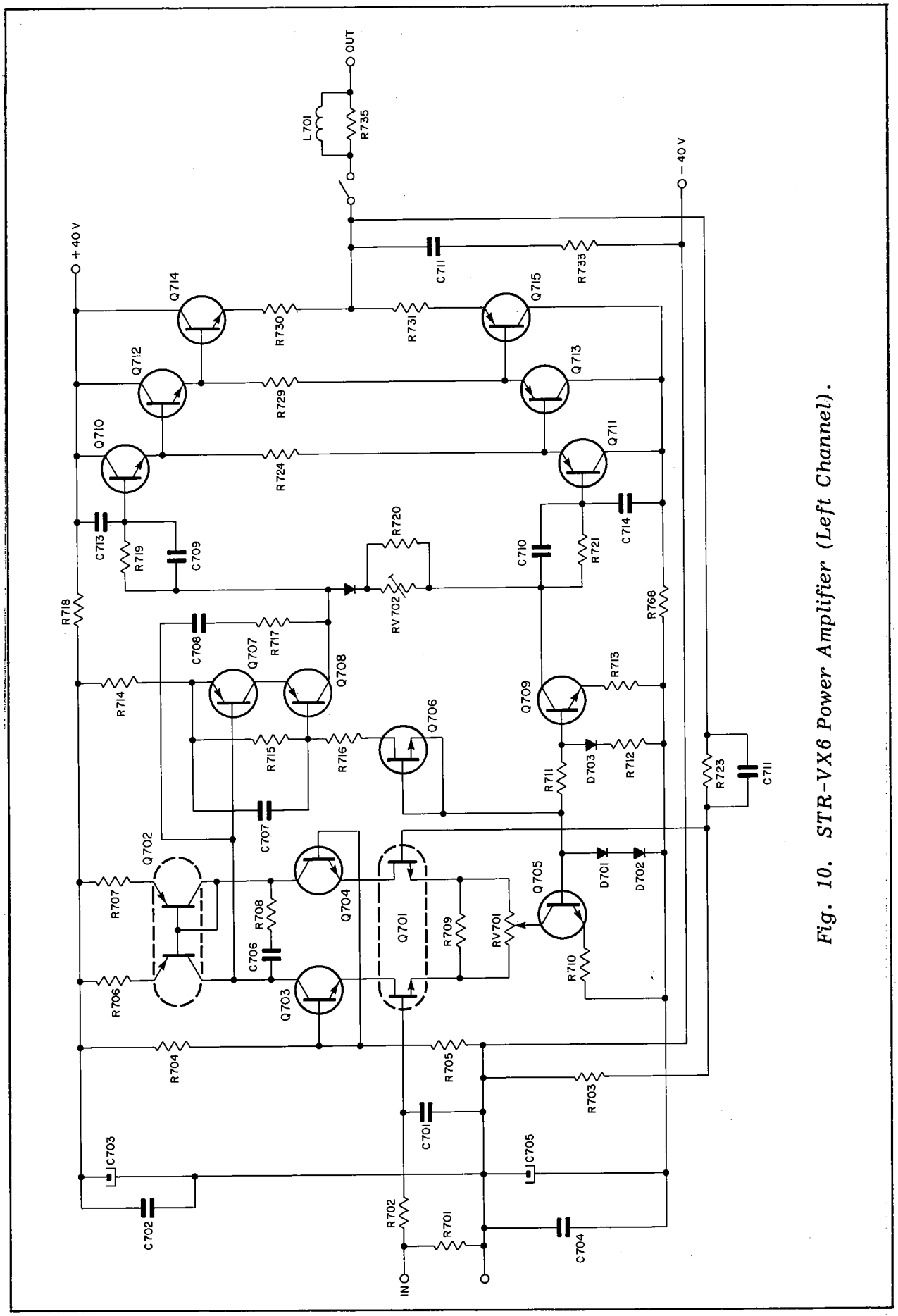


Fig. 10. STR-VX6 Power Amplifier (Left Channel).

Power Supply (all models)

The STR-VX1, -VX2 and -VX4 employ conventional power supplies. The STR-VX5 and -VX6 employ pulse power supplies. The configuration of the pulse power supply is identical to that of previous models, and will not be discussed here.

STR-VX3, -VX4, -VX5 and -VX6 Protection Circuit

Table 2 summarizes the protection circuit employed in each model. The protection circuits used in the STR-VX6 will be discussed here.

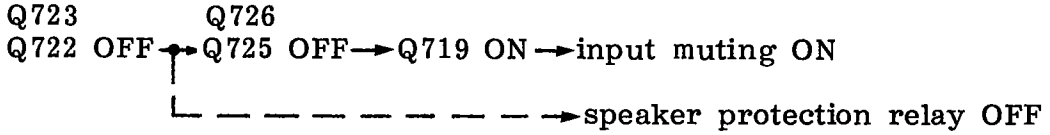
Table 2.

	STR-VX6	-VX5	-VX4	-VX3	-VX2	-VX1
Speaker Protection	relay	relay	relay	relay	circuit breaker (1.9A)	circuit breaker (1.9A)
Current Limiter	Yes	Yes	Yes	No	No	No
DC Voltage Detector	Yes	Yes	Yes	Yes	No	No
Impedance Detector	Yes	Yes	Yes	Yes	No	No
B+ Detector	Yes	Yes	Yes	Yes	No	No
Input Muting	Yes	No	No	No	No	No
Primary Fuse or Circuit Breaker	5A	5A	3.15A	2.5A	2A	2A
In-Rush Current Relay	Yes	Yes	No	No	No	No

Speaker Protection Relay Drive and Input Muting

A relay is employed to protect both the speakers and the amplifier itself. The following events take place when the power switch is turned on or turned off. Refer to Figure 11.

1. Immediately after power switch is turned on



2. Several seconds after power switch is turned on

   Base-emitter voltage of Q722 rises to 0.6V.

   Q723 Q726
   Q722 ON → Q725 ON → Q719 OFF → input muting OFF
   → speaker protection relay ON

3. Power switch is turned off

   Q723 Q726
   Q722 OFF → Q725 OFF → Q719 ON (momentarily) → input muting ON (momentarily)
   → speaker protection relay OFF

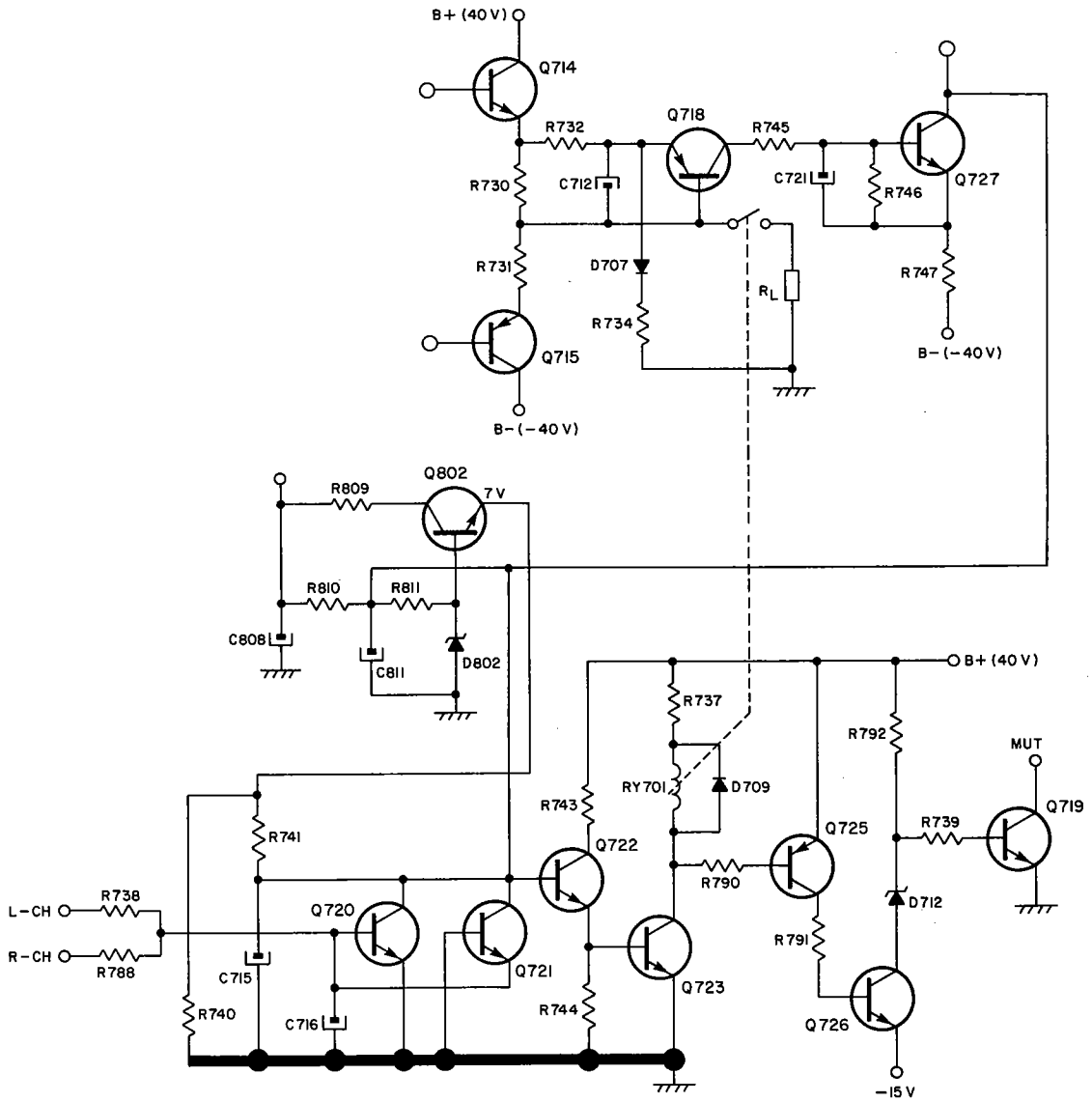


Fig. 11. Relay Drive, Input Muting and Impedance Detector Circuit.

Impedance Detector

The circuit feeds a signal to the relay drive circuit to open the relay switch in order to protect the speakers if excess current flows in the output stage. When the base-emitter voltage of Q718 is raised to 0.6V, Q727 turns on. Then, the collector voltage of Q727 goes low. Because the collector of Q727 is connected to the base of Q722, Q722 turns off, disengaging the relay switch as shown in Figure 11.

Current Limiter

When a very low impedance speaker is connected or extremely high output current flows in the output stage, the current limiter operates to protect the amplifier. If the base-emitter voltage of Q716 is raised to 0.6V because of an excessive voltage drop across R730, Q716 turns on, and the voltage between points A and B will become about 0.6V as shown in Figure 12. This cuts off the driver transistors (Q710, Q712) and output transistor Q714. Likewise, if the base-emitter voltage of Q717 is raised to 0.6V via R728 from R731, Q717 turns on. Then Q711, Q713 and Q715 switch off. D705 and D706 are connected to prevent current from flowing from the output to the input of the driver stage via Q716 and R727, or Q717 and R728.

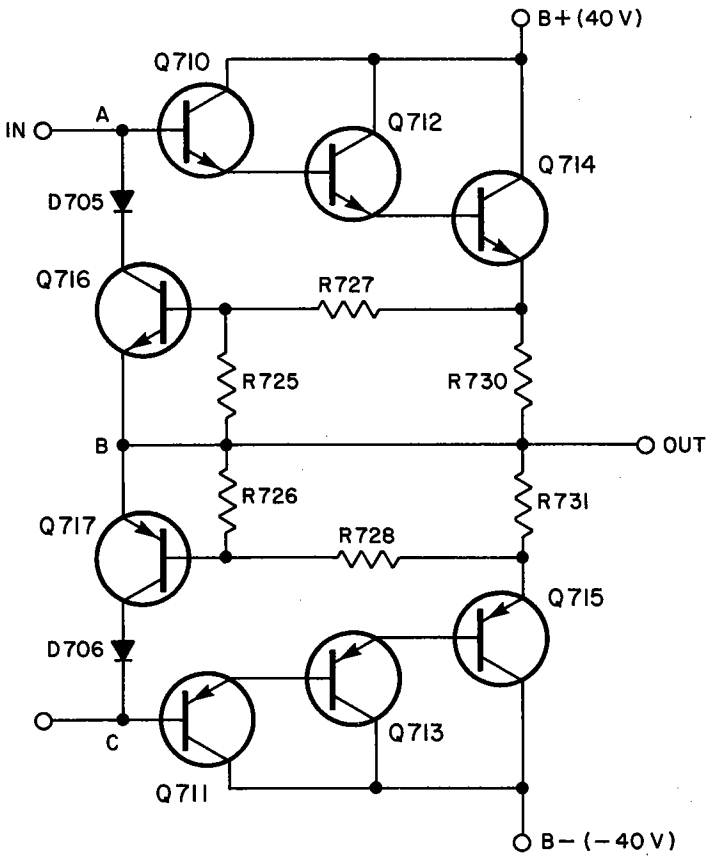


Fig. 12. Current Limiter.

STR-VX5, -VX6 Electronic Switch

The STR-VX5 and -VX6 employ electronic switches for the input function selectors. An integrated circuit (CX-770) contains 6 of these CMOS analog switches as shown in Figure 13. As the switches are remotely controlled by a DC voltage, the input function selectors can be located near the input terminals. This means that there is less hum and noise pickup from long wires.

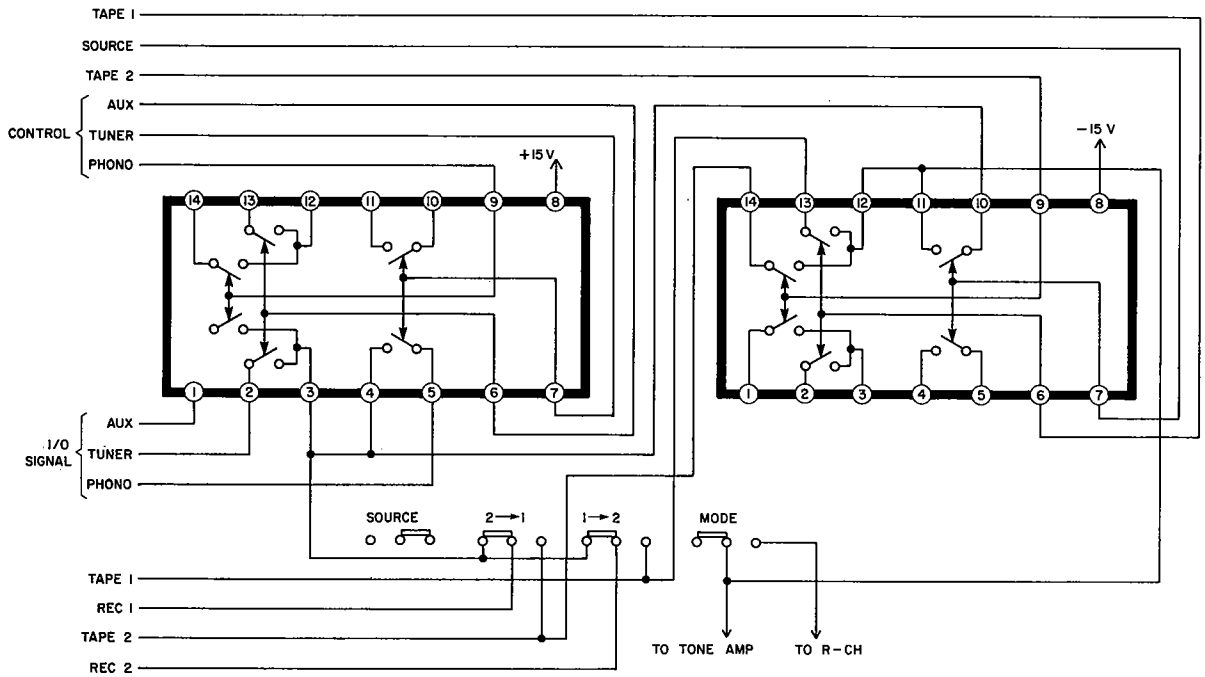


Fig. 13. Function Selector Electronic Switches.